

Application Programming

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K. Allen, C. McChesney (LANL), W. D. Klotz (ESRF) I.
Kriznar, A. Zupanc (Cosylab)

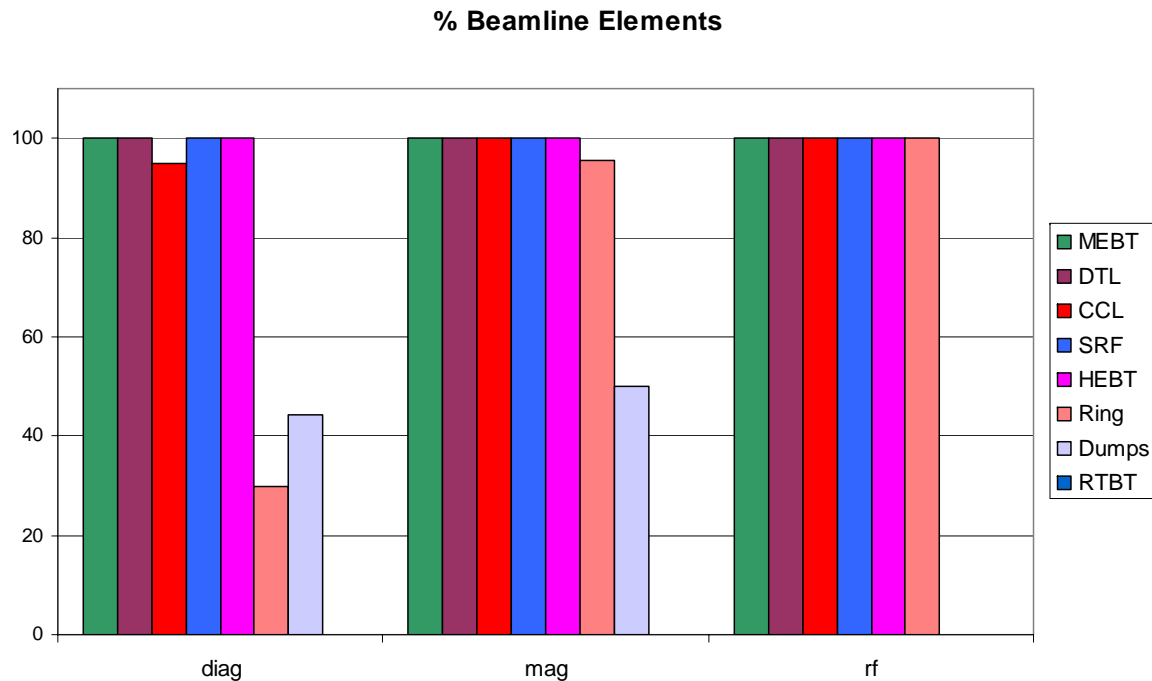
May 11-13, 2004

Application Programming Update Since November 2003



- XAL Infrastructure
 - Database population
 - Client - server development
- Online model
 - Benchmarking
 - Example uses
 - Analysis
- Applications
 - ~ 20 XAL applications

Database Population

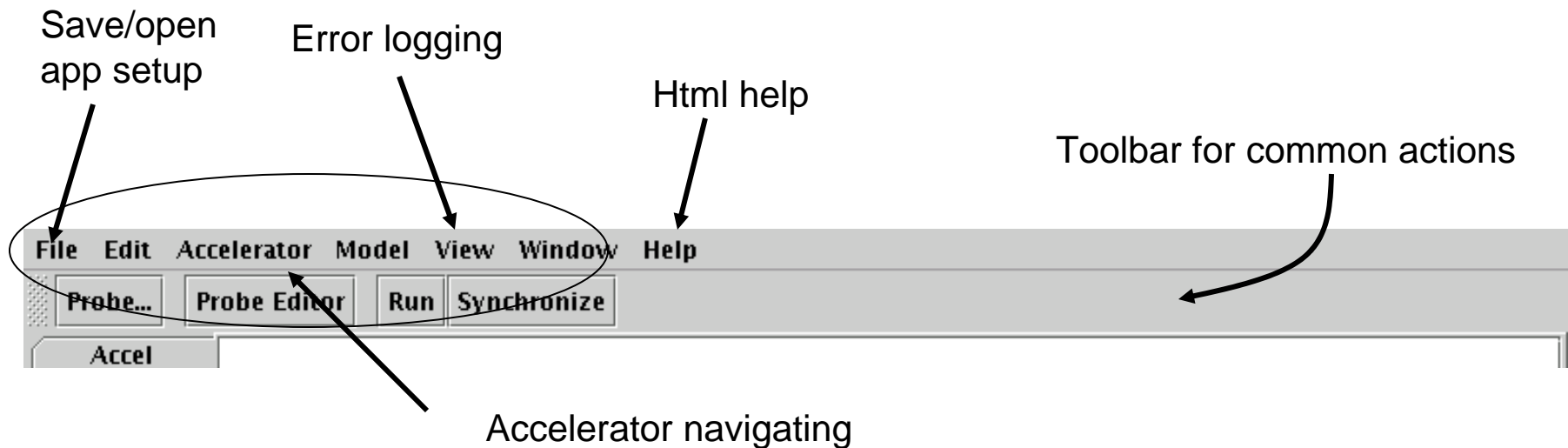


- Mostly populated for MEBT -> Ring
 - RTBT, Injection Dump and Extraction Dump are lacking
- Over 1500 beamline elements are populated
- Using database (e.g. global coordinates, PS / magnet mappings)

“Standardizing” Application Program Efforts



- An Application Framework is developed and used as a common starting point for application programs (*T. Pelaia*)

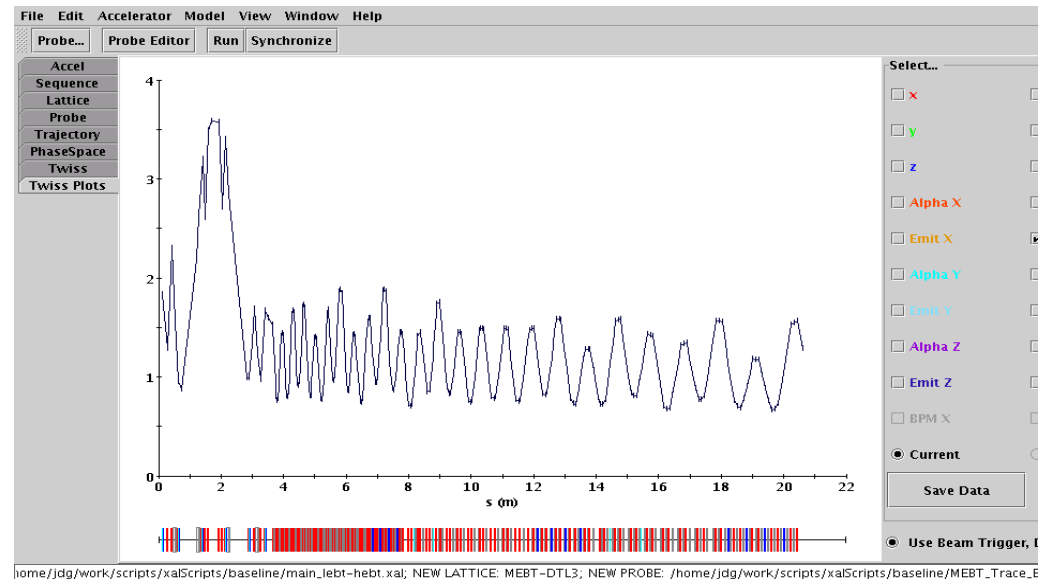


- Common area for data export - subdivided by application
 - Accessible from the elog
- Use of “time-stamp” file names for data export

The online model (C.K. Allen, C. McChesney, W. D. Klotz, P. Chu)

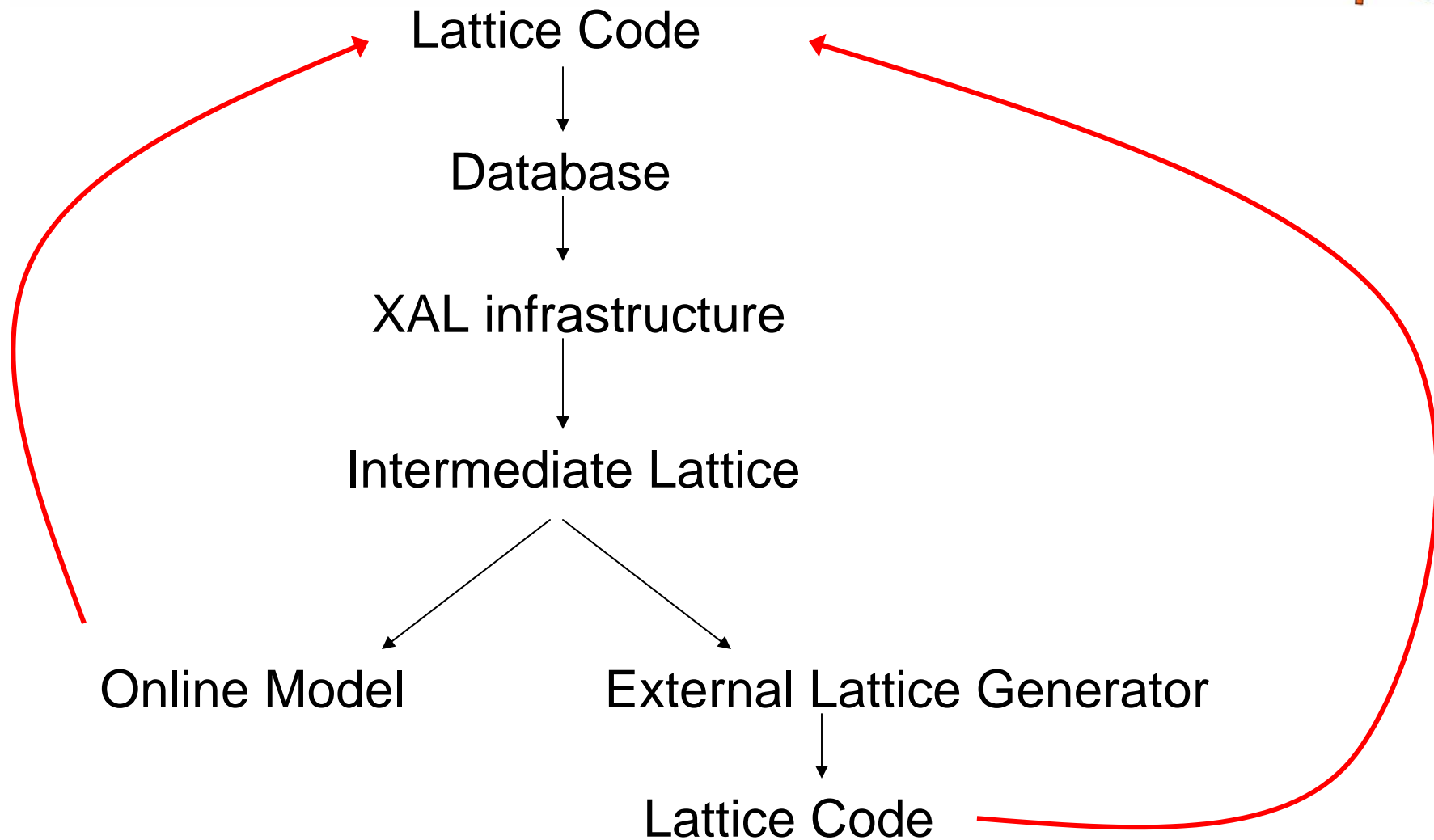


- Algorithm refinement
 - Adaptive step size (with space charge)
 - Ring and transport-line modeling
 - Energy and phase tracking in accelerating elements (e.g. DTL tanks)
- Data source
 - Design
 - Machine
 - Mixed design / machine
 - User “what if” capability
- Data analysis scripts

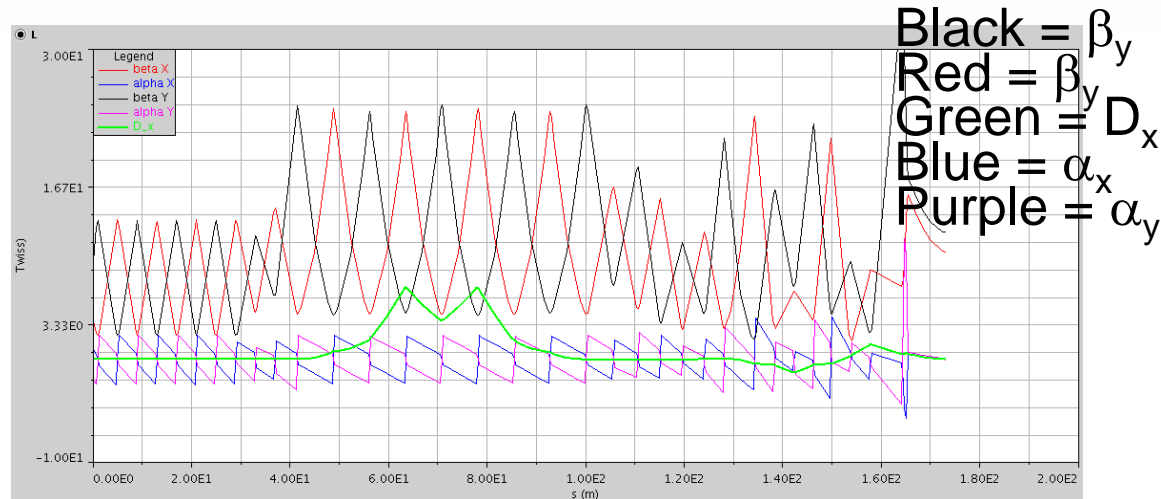


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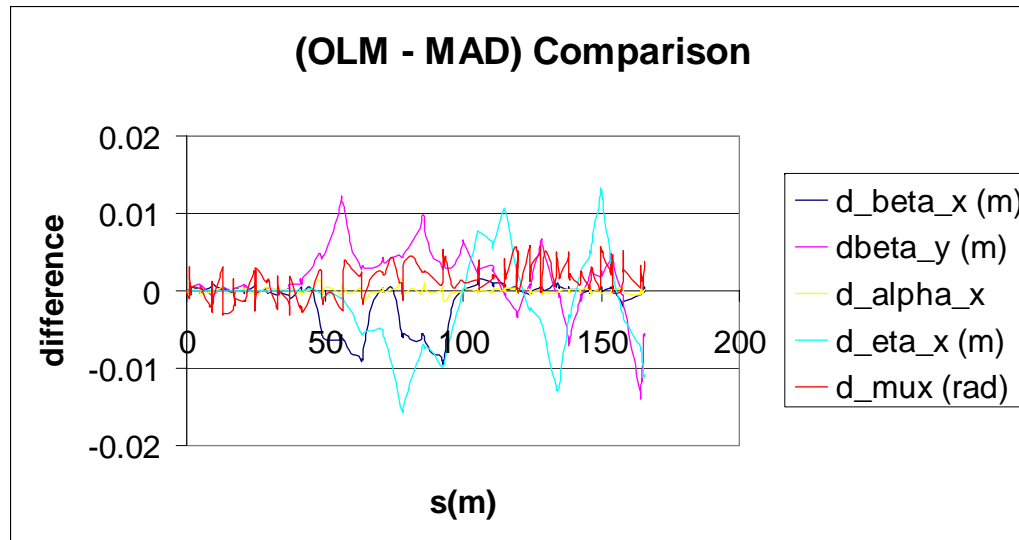
External Lattice Check Procedure



HEBT Lattice Check

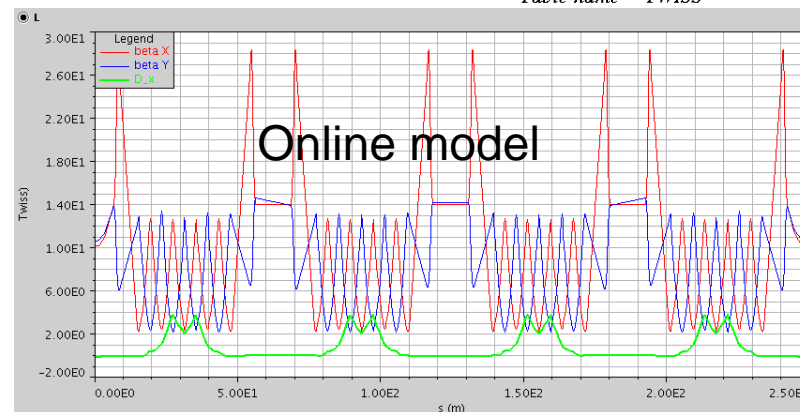
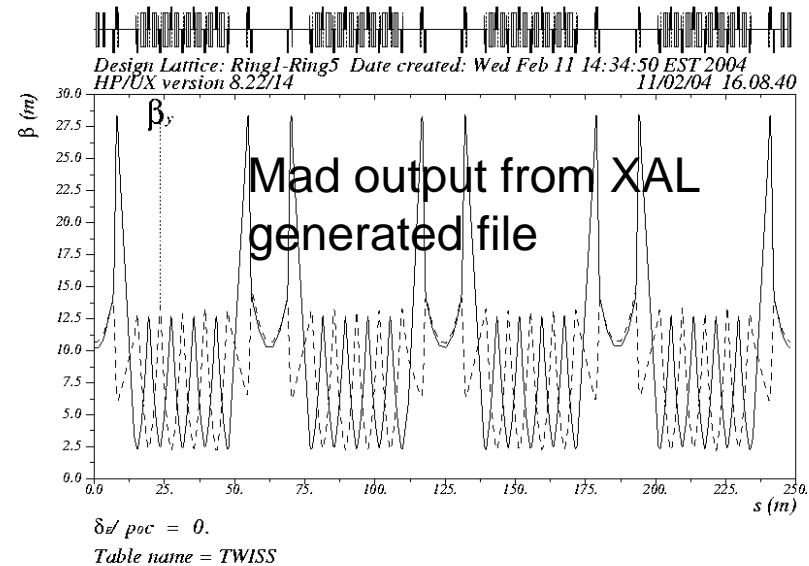
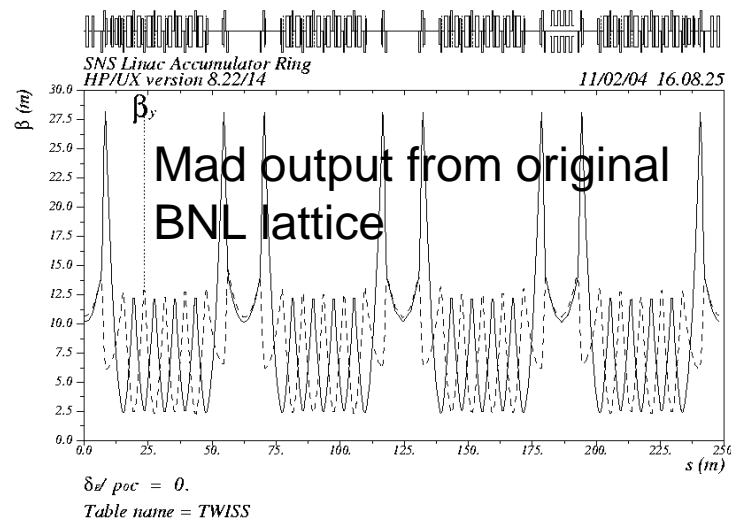


Online model
HEBT results



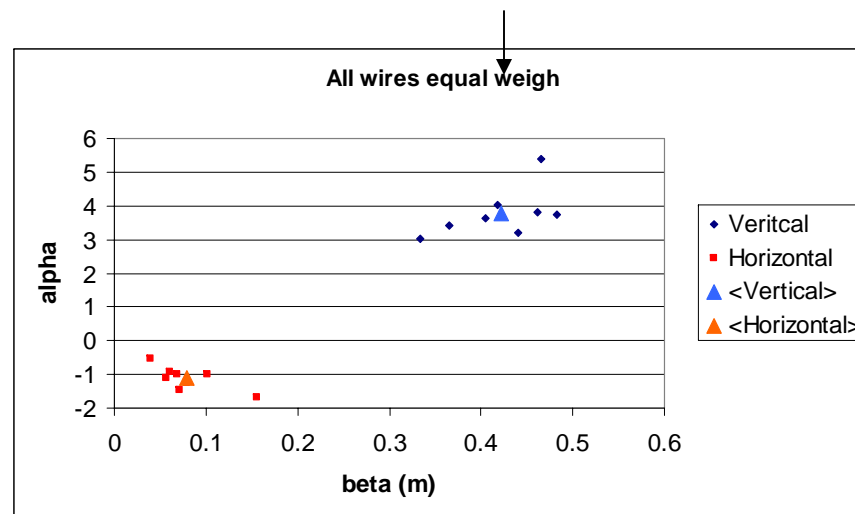
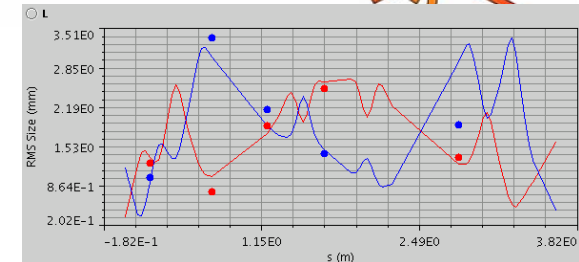
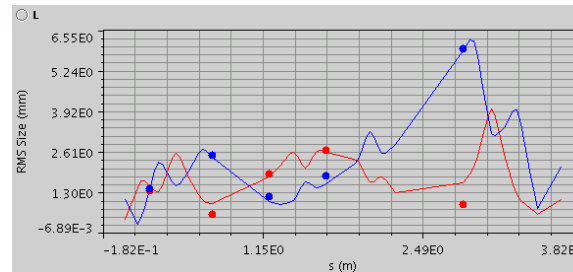
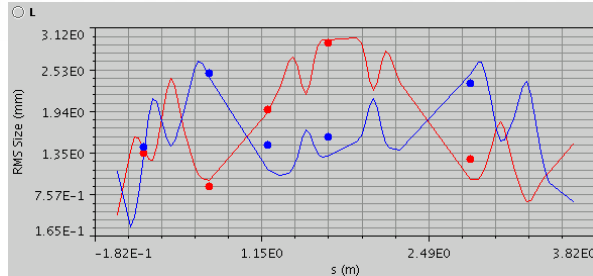
Comparison of
online model and
MAD results

Ring Lattice Check (P. Chu, S. Cousineau)



- Good agreement in MAD results, comparing the original starting point and a file generated with XAL (using default values from the databcase), and the online model.

Transverse Beam Property Analysis (preliminary results)

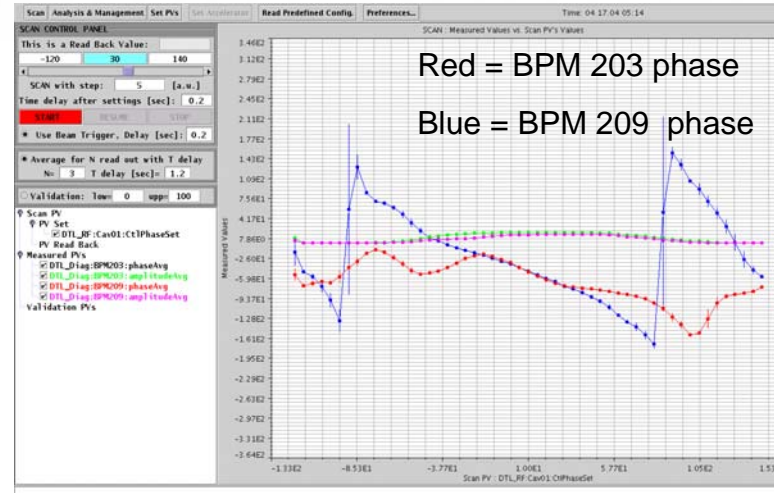


- Compare measured and model predicted beam sizes in the MEBT for a variety of MEBT magnet settings
- Solve for MEBT entrance twiss parameters to best match measured wire profiles under a variety of quad settings
- Uses solver + online model packages within a script.

Longitudinal phase scan signature matching analysis (preliminary)

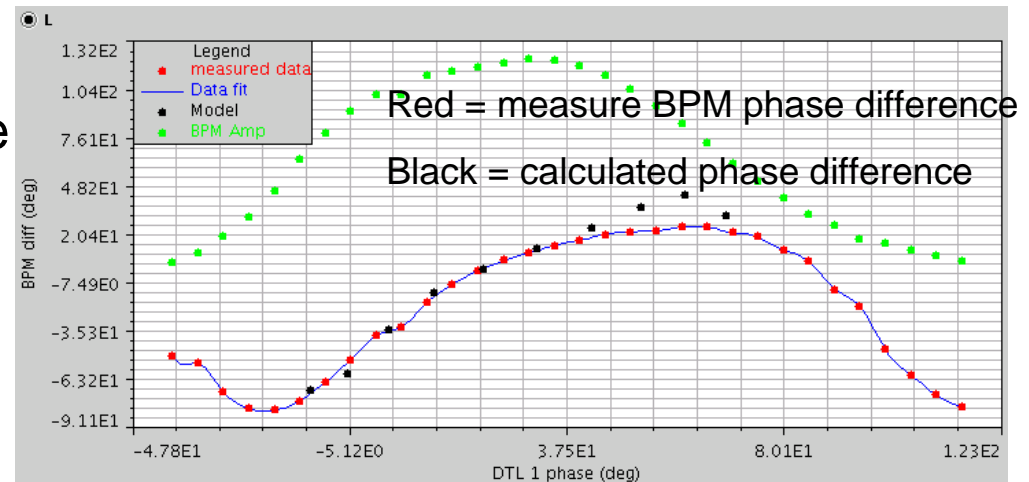


- Scan the DTL tank phase and observed downstream BPM phase signature



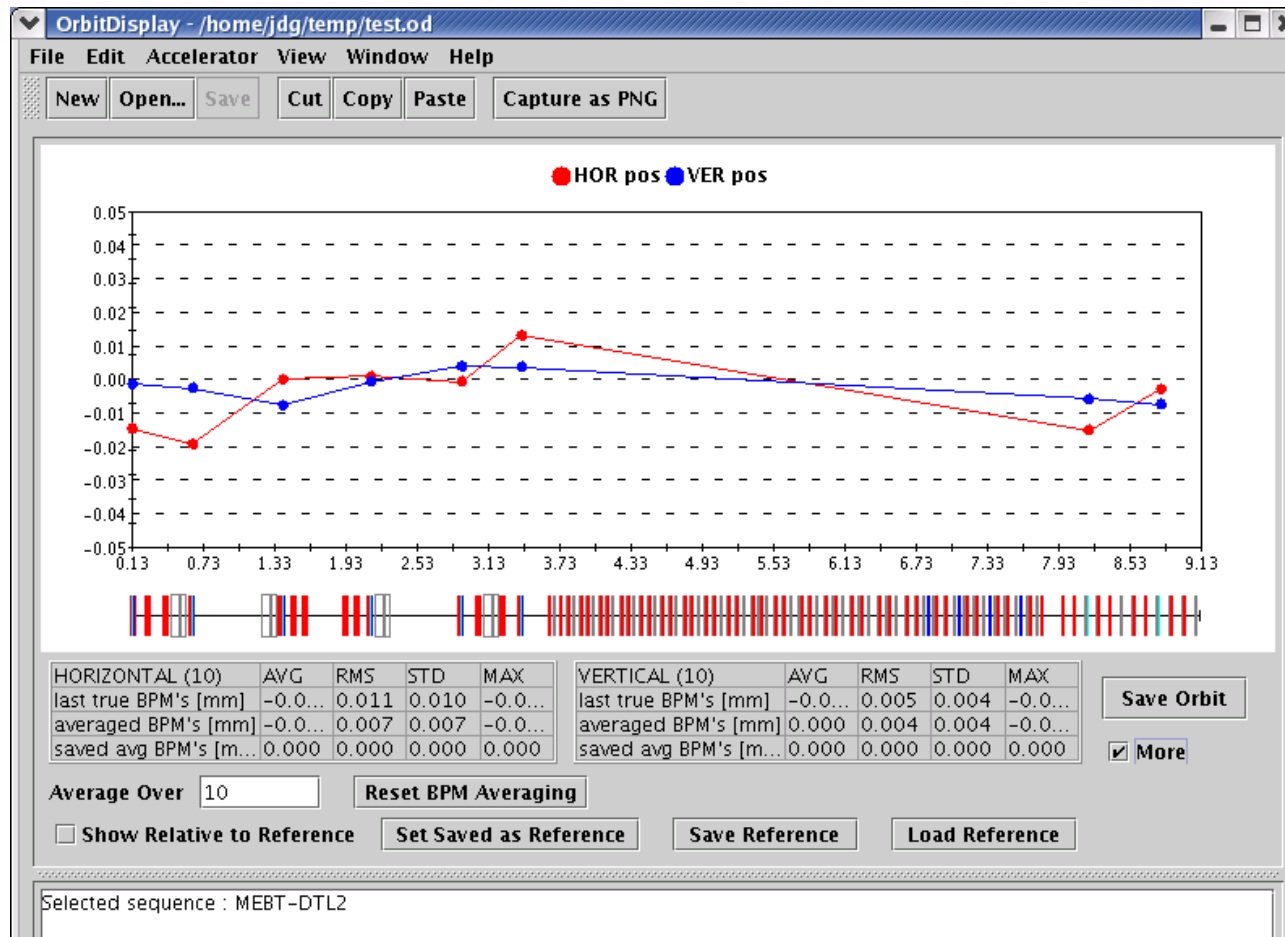
DTL phase

- Match the observed BPM phase difference signature with the online model by varying the input energy, cavity phase and amplitude.
- Done offline with a script



DTL phase

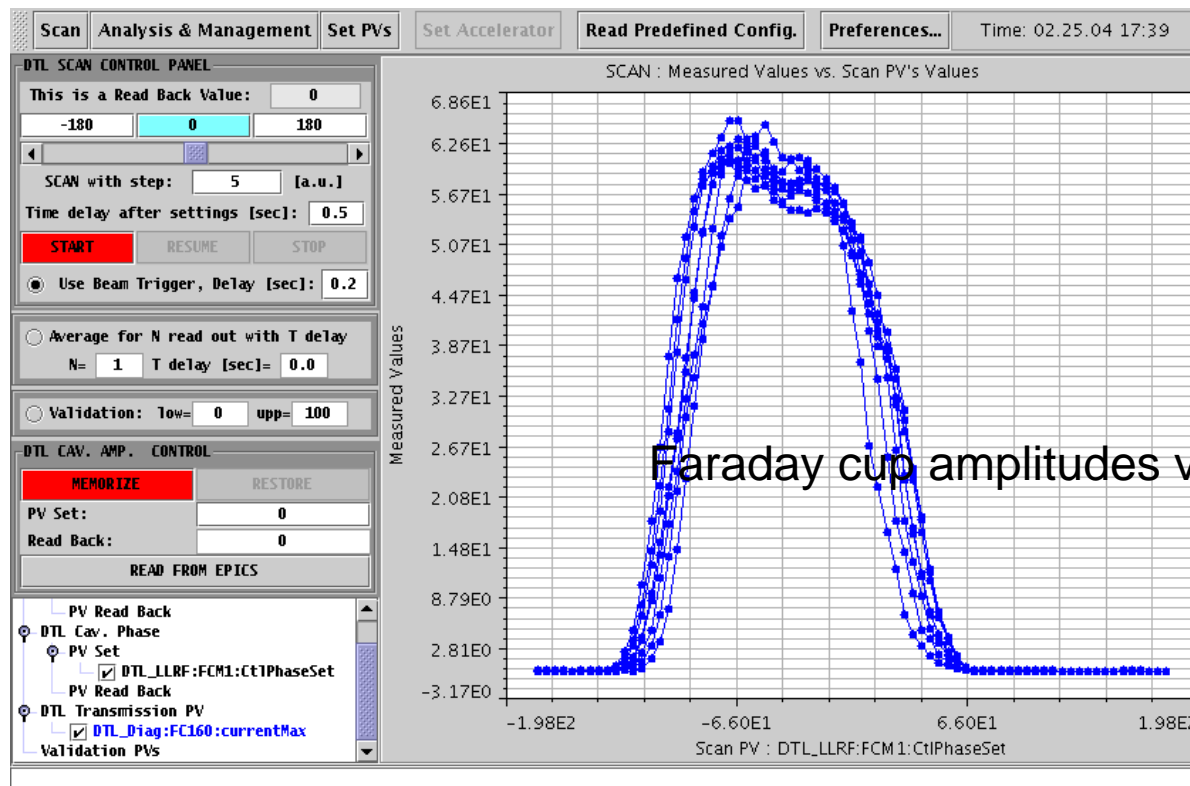
Orbit Display (Cosylab)



- Uses the XAL application framework
- Provides statistics
- Can save the setup

1-D Scan Application *(A. Shishlo)*

- Provides an easy way to scan one quantity and monitor others
- Can average over pulses, scan multiple times, pause
- Analysis includes fitting, intersection finding, min/max, etc.
- Easy way to do a quick unanticipated experiment
- Predefined scans with specialized analysis are possible
 - DTL and MEBT phase + amplitude setting applications



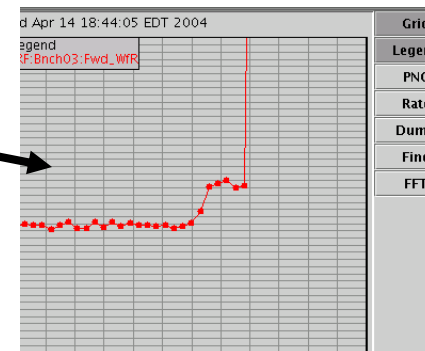
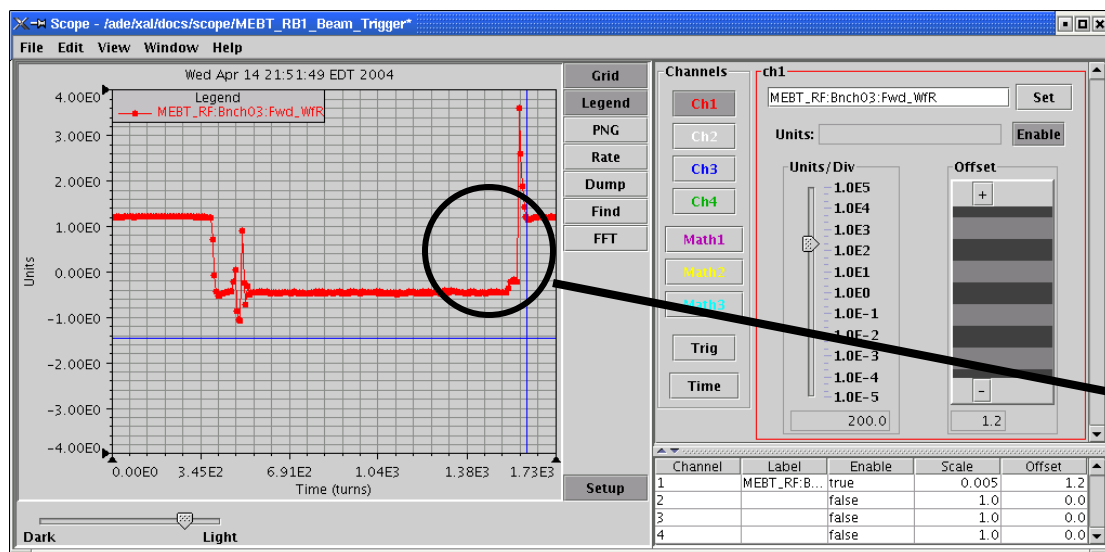
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Scope Application, Triggered Acquisition

(T. Pelaia)



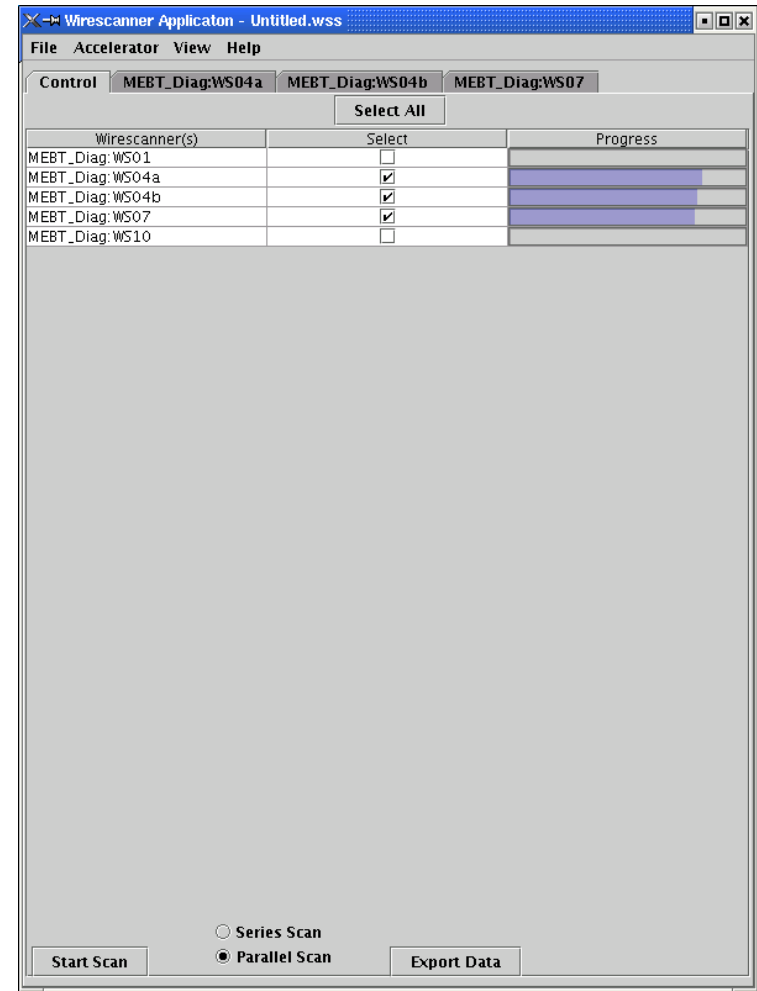
- The Digital Oscilloscope – with a similar user interface as analog scopes
- MEBT rebuncher (RF) forward power trace with beam loading:
 - RF = 1 msec @ 20 Hz, beam = 50 μ sec @ 1 Hz
 - Use the correlator to filter only RF signals with beam pulses
- Potential for future applications
- Requires vigilance on good signal time stamps and proper time waveform packaging



Wireshooter Application (S. Bunch)

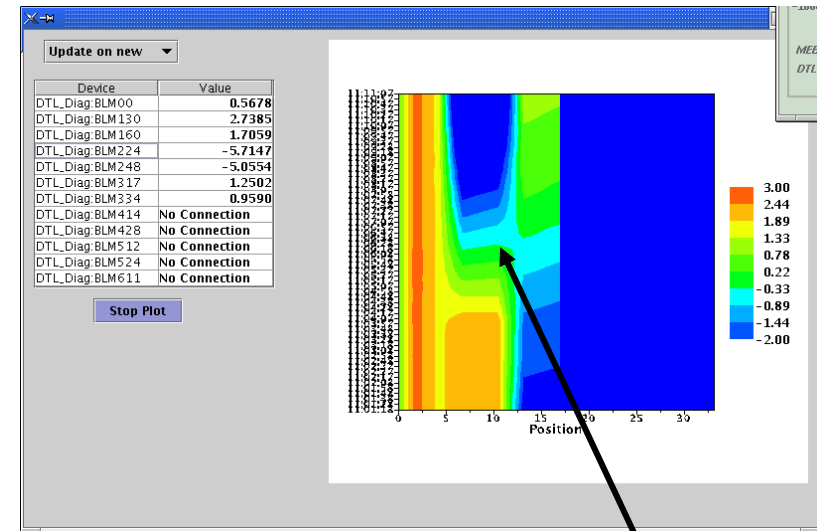
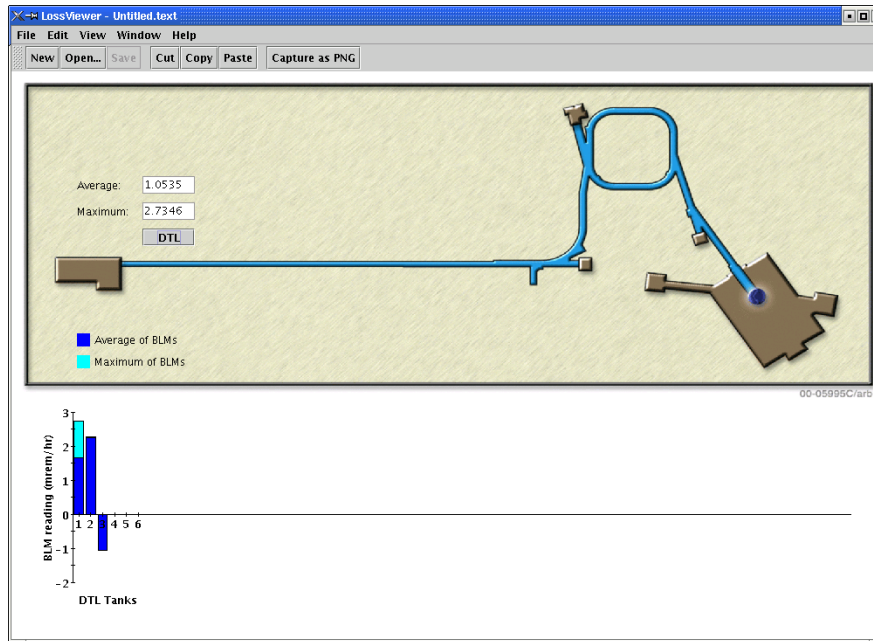


- Provides an easy way to quickly run many wire scans at once
 - Standard accelerator browser
 - Exports wire data to a file
 - View individual profile results
 - Translate data to Matlab format
- Was suggested in last commissioning “lessons learned” (Nov. ‘03)
 - Student intern started it in Jan. ‘04
 - Ready for commissioning (April)



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Loss Viewer Application (S.Cousineau)



- View a summary of beam loss by machine section
 - “Zoomable” to specific BLMs
 - Viewable as fraction of permissible loss
- Waterfall display of a specific beamline portion
 - Faraday cup inserted here

Service Applications (T. Pelaia)



- Started using service based applications
 - Using “off-the-shelf” protocols, services
 - Rendezvous for networking details, Xml-rpc for passing the information – simple interfaces
- Application Viewer uses this to monitor other XAL applications
 - Application framework provides broadcast capability
 - Used to kill “forgotten” applications

The screenshot shows a window titled "ApplicationViewer" with a menu bar (File, Edit, View, Window, Help) and two buttons: "Garbage Collect" and "Force Quit". Below these is a label "update period (sec):" followed by a text box containing the value "30". The main area of the window contains a table with the following data:

Application	Host	Launch Time	Total Memory (kB)	Free Memory (kB)	Service Status
ApplicationViewer	ics-srv-phy1	Apr 28, 2004 11:2...	3,400.000	606.672	Okay
Launcher	ics-srv-phy1	Apr 28, 2004 11:3...	3,460.000	1,661.242	Okay
MPS Client	ics-srv-phy1	Apr 28, 2004 11:2...	4,544.000	460.922	Okay
PV Logger	ics-srv-phy1	Apr 28, 2004 11:4...	3,332.000	1,158.633	Okay

Service Applications, Machine Protection System Post Mortem (T. Pelaia)



- Service constantly monitors MPS events, sorts the flood of MPS signals by time per MPS trip
 - Keeps statistics
 - Keeps log of past 1000 events
- Multiple clients can access it to display results
- Replaces the old standalone post mortem

MPS Client - Browser

File Edit Special View Window Help

Reload Signals

update period (sec): 30

Host	Launch Time	Last Check	Service Status
lcs-srv-phy1	Apr 15, 2004 15:38:44 EDT	Apr 28, 2004 11:39:52 EDT	Okay

MPS Types:

FPL

FPAR

Log **PVs**

Latest MPS Event:
Mon Apr 26 14:47:02 EDT 2004

Signal	Timestamp
RFQ_Vac:SGV:FPL_Src_chan_status	Apr 26, 2004 14:47:02.630132942
LEBT_Vac:SGV:FPL_Src_chan_status	Apr 26, 2004 14:47:02.630132942

Daily First Hit Summary:
No MPS events since Apr 28, 2004 00:00

Buffer dump

MPS Client - FPL Buffer

File Edit View Window Help

Refresh Dump Text Dump HTML

Mon Apr 26 14:47:02 EDT 2004

Signal	Timestamp
RFQ_Vac:SGV:FPL_Src_chan_status	Apr 26, 2004 14:47:02.630132942
LEBT_Vac:SGV:FPL_Src_chan_status	Apr 26, 2004 14:47:02.630132942

Mon Apr 26 14:02:29 EDT 2004

Signal	Timestamp
MEBT_Vac:SGV_closed:FPL_Src_chan_status	Apr 26, 2004 14:02:29.961085166

Mon Apr 26 14:02:29 EDT 2004

Signal	Timestamp
OTL_Mag_PS_DC239:FPL_CCL_B5_chan_status	Apr 26, 2004 14:02:29.313347000
OTL_Mag_PS_DC245:FPL_CCL_B5_chan_status	Apr 26, 2004 14:02:29.313347000
OTL_Mag_PS_DC242:FPL_CCL_B5_chan_status	Apr 26, 2004 14:02:29.313347000
MEBT_Mag_PS_QV04:FPL_Src_chan_status	Apr 26, 2004 14:02:29.313347118
MPS_FPL_Src_FPL_Src_chan_status	Apr 26, 2004 14:02:29.313348122
MPS_FPL_CCL_B5_FPL_Src_chan_status	Apr 26, 2004 14:02:29.313350544
MEBT_Mag_PS_QV05a10:FPL_Src_chan_status	Apr 26, 2004 14:02:29.313350780
MEBT_Mag_PS_QH14:FPL_Src_chan_status	Apr 26, 2004 14:02:29.313350780
MPS_FPL_Src_QH12:FPL_Src_chan_status	Apr 26, 2004 14:02:29.313350780
ICS_MPS_IPS1:FPL_Src_chan_status	Apr 26, 2004 14:02:29.313362122
MEBT_Mag_PS_QV06a09:FPL_Src_chan_status	Apr 26, 2004 14:02:29.313362122
MEBT_Mag_PS_QH01:FPL_Src_chan_status	Apr 26, 2004 14:02:29.314315336
MEBT_Mag_PS_QH07a08:FPL_Src_chan_status	Apr 26, 2004 14:02:29.314333767

Mon Apr 26 13:34:35 EDT 2004

Signal	Timestamp
MPS_FPL_CCL_B5_FPL_Src_chan_status	Apr 26, 2004 13:34:35.475951949

Mon Apr 26 11:29:15 EDT 2004

Signal	Timestamp
MPS_FPL_CCL_B5_FPL_Src_chan_status	Apr 26, 2004 11:29:15.738165371

Fri Apr 23 16:15:48 EDT 2004

Signal	Timestamp
MEBT_Mag_PS_QH03:FPL_Src_chan_status	Apr 23, 2004 16:15:48.315905413

Fri Apr 23 16:15:46 EDT 2004

Signal	Timestamp
MEBT_Mag_PS_QV02:FPL_Src_chan_status	Apr 23, 2004 16:15:46.596937310

Fri Apr 23 16:15:45 EDT 2004

Signal	Timestamp
MEBT_Mag_PS_QH01:FPL_Src_chan_status	Apr 23, 2004 16:15:45.284051891

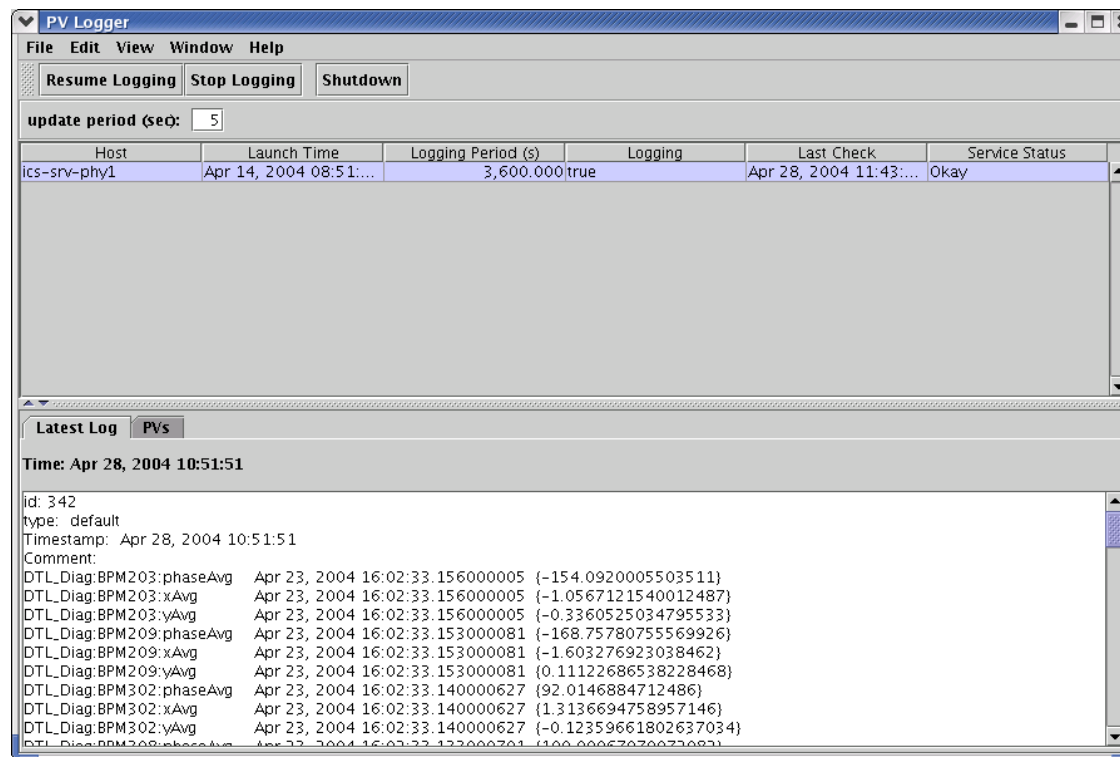
Fri Apr 23 16:15:42 EDT 2004

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Service Applications, “PV Logger” (T. Pelaia)



- Server grabs “sets” of data the accelerator physics is interested in
 - Magnet settings, RF settings, BPM readbacks
 - Posts to the database once / hour, or on demand
- Planning to use this as a data source for the online mode

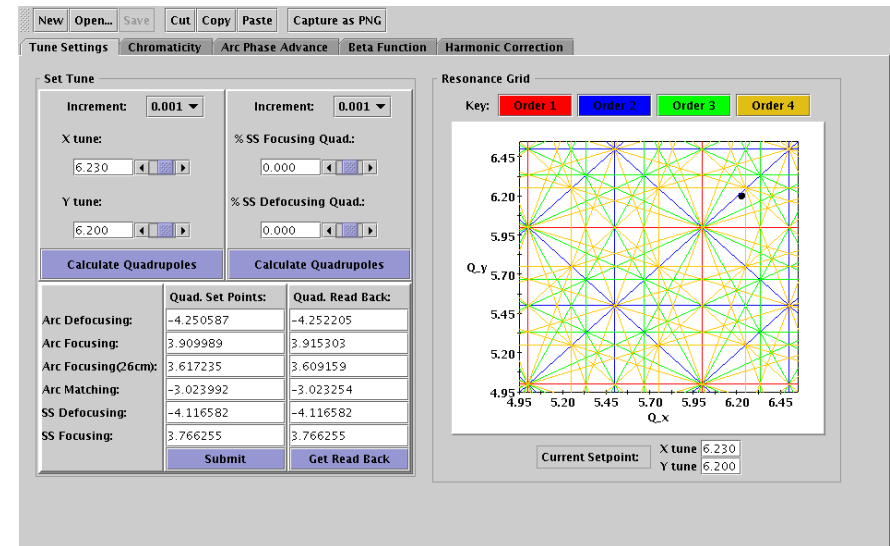


Client application
viewing a PV set

Starting on Ring Apps



- Members of the AP group (S. Danilov, S. Cousineau) are preparing Ring applications using XAL tools
- HEBT matching algorithms
- Ring Optics settings
- Injection

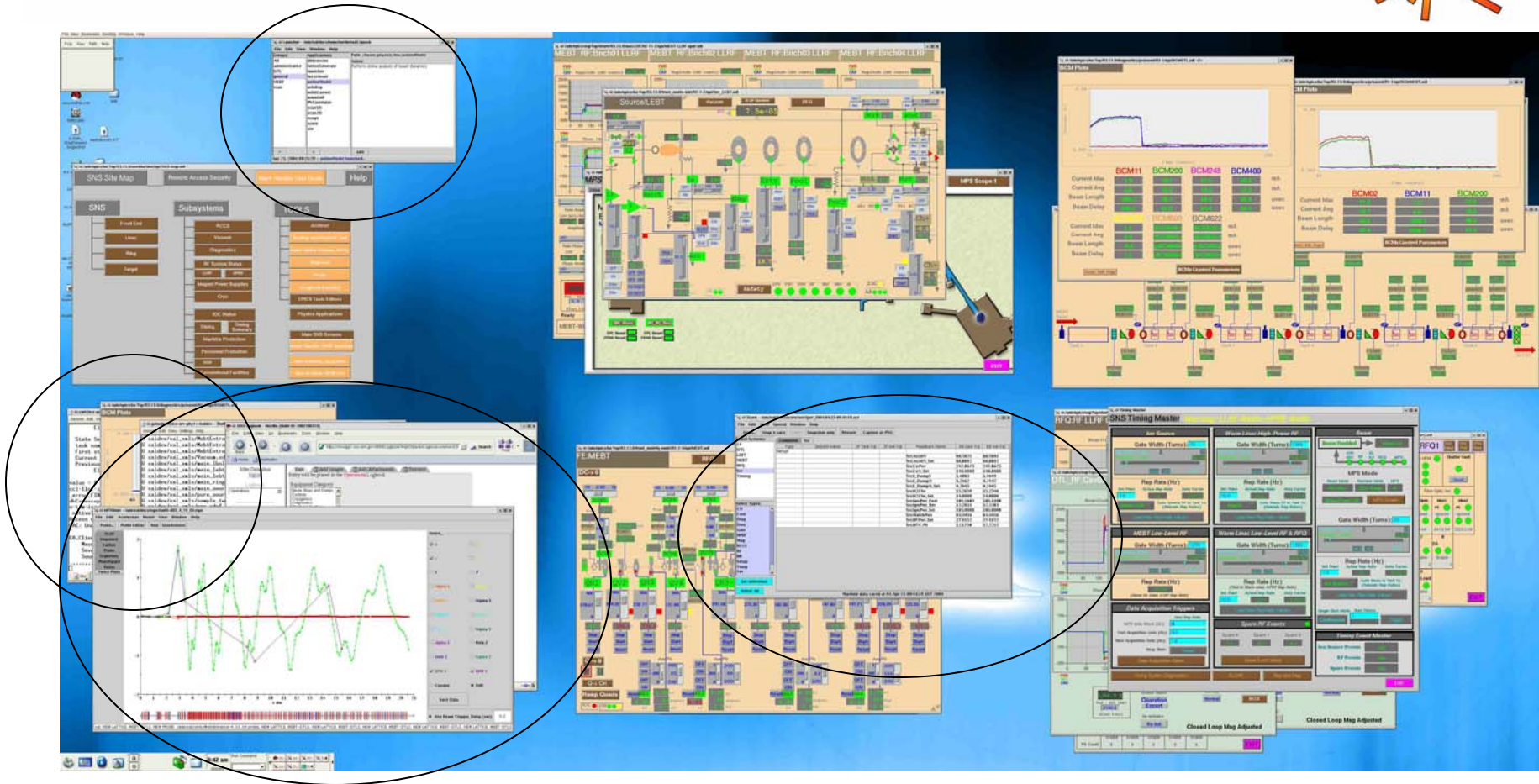


Summary



- The XAL application programming infrastructure is in place and working.
 - ~ 20 applications written
 - Online modeling is available
 - Service applications are started
- Directions
 - More applications
 - Data analysis
 - Database, database, database

XAL is used



- Operator console snapshot, 4/23/04